We claim:

1. A method comprising:

injecting a relatively small volume of a pilot fuel into a combustion chamber of a compression ignition engine so as to ignite a relatively large volume of a liquid primary fuel in the combustion chamber, while controlling at least one of a timing, Tp, of initiation of pilot fuel injection, a pilot fuel injection duration, Dp, and an ignition delay period, Di, such that Dp/Di is < 1.

2. The method as recited in claim 1, wherein the controlling step comprises obtaining a mixing period, Dm > 1° c.a., where Dm = Di – Dp.

3. The method as recited in claim 2, wherein the controlling step comprises obtaining a Dm of between 5° c.a. and 40° c.a.

4. The method as recited in claim 2, wherein the controlling step comprises altering autoignition timing, Ti.

5. The method as recited in claim 2, wherein Di is altered by adjusting at least one of

(A) a temperature, ACT, of an air charge admitted into the combustion chamber;

(B) a pressure, MAP, of the air charge admitted into the combustion chamber, and

(C) an air/fuel ratio, lambda, of a natural gas/air mixture in the combustion chamber.

6. The method as recited in claim 5, wherein ACT is adjusted by at least one of

(A) altering a percentage of exhaust gas recirculation, EGR, from an exhaust of the engine to the combustion chamber,

(B) altering operation of at least one of 1) a supercharger, 2) a turbocharger, 3) an aftercooler, and 4) an expansion turbine located downstream of the aftercooler,

(C) altering operation of an intercooler which cools intake air being supplied to the combustion chamber, and

(D) injecting water into an intake mixture.

7. The method as recited in claim 5, wherein MAP is adjusted by adjusting at least one of

A) an operating state of a turbo air bypass valve to control a percentage of intake airflow that bypasses the compressor output of the turbocharger of the engine, and

B) a waste gate or a variable turbine nozzle of a turbocharger.

8. The method as recited in claim 5, wherein lambda is adjusted by altering at least one of

A) a value of a vaporized fuel charge supplied to the intake system or combustion chamber,

B) a mass of the air charge supplied to the combustion chamber,

C) ACT,

D) MAP, and

E) a fraction of firing cylinders, FFC, in a skipfire operation.

10. The method as recited in claim 4, wherein Ti is altered by adjusting exhaust gas recirculation, EGR.

11. The method as recited in claim 2, wherein the controlling step comprises adjusting at least one of Tp and Dp.

12. The method as recited in claim 2, wherein the controlling step comprises adjusting a rate of pilot fuel combustion in the combustion chamber by adjusting at least one of a size, a number, a distribution, and a fraction of vaporization of pilot fuel droplets in the combustion chamber.

14. The method as recited in claim 1, wherein the injecting step comprises operating an electronically actuated fuel injector coupled to a source of a fuel that is combustible by compression-ignition.

15. The method as recited in claim 14, wherein the injector comprises one which injects fuel in an expanding cloud during at least a substantial portion of an injection event.

16. The method as recited in claim 1, wherein said pilot fuel has a relatively narrow boiling point temperature range and lower autoignition temperature than said primary fuel.

17. The method as recited in claim 16, wherein said pilot fuel comprises diesel fuel and said primary fuel comprises Dimethyl Ether.

18. The method as recited in claim 1, wherein said primary fuel is supplied to the engine so as to homogenously mix with air, thereby permitting homogenous charge compression ignition (HCCI) of said primary fuel.

19. The method as recited in claim 18, wherein said primary fuel is supplied to an air intake system of said engine as a fog of droplets having a mean diameter in the micron range.

20. The method as recited in claim 19, wherein said droplets have a mean diameter of about 5 microns to about 20 microns.

21. The method as recited in claim 19, wherein said primary fuel is supplied via at least one fogging nozzle.

22. The method as recited in claim 19, wherein said primary fuel is injected either directly into an air intake manifold of said engine or into an inlet of a compressor of a turbocharger of said engine.

23. A method comprising:

supplying a relatively large volume of a liquid primary fuel to a combustion chamber of a compression ignition engine so as to form a homogenous mixture of primary fuel and air in said combustion chamber;

injecting a relatively small volume of a pilot fuel into said combustion chamber, said pilot fuel having a lower autoignition temperature than said primary fuel and having a relatively narrow boiling point temperature range; and

autoigniting said pilot fuel by compression ignition and igniting said primary fuel through combustion of said pilot fuel, thereby obtaining pilot assisted HCCI combustion of said primary fuel.

24. The method as recited in claim 23, further controlling at least one of a timing, Tp, of initiation of pilot fuel injection, a pilot fuel injection duration, Dp, and an ignition delay period, Di, such that Dp/Di is < 1.

25. The method as recited in claim 23, wherein said pilot fuel comprises diesel fuel and said primary fuel comprises Dimethyl Ether.

26. The method as recited in claim 23, wherein said primary fuel is supplied to an air intake system of said engine as a fog of droplets having a diameter in the micron range.

27. The method as recited in claim 26, wherein said droplets have a diameter of about 5 microns to about 20 microns.

28. The method as recited in claim 23, wherein said primary fuel is supplied via at least one fogging nozzle.

29. The method as recited in claim 28, wherein said primary fuel is supplied via a plurality of fogging nozzles, and further comprising adjusting a primary fuel supply quantity by at least one of

A) adjusting primary fuel supply pressure;

B) pulse-width-modulating flow through at least one of said nozzles;

C) varying an orifice diameter of at least one of said nozzles; and

D) disabling at least one of said nozzles.

30. The method as recited in claim 28, wherein said fogging nozzle has an impaction device against which injected fuel impinges to atomize fuel droplets.

31. A method comprising:

A) injecting a liquid fuel into an air stream so as to form a homogenous mixture of air and atomized droplets of fuel having a mean diameter of less than about 50 microns;

B) admitting said mixture into a combustion chamber of an internal combustion engine; and

C) igniting the liquid fuel in said mixture by compression ignition so as to achieve homogonous charge compression ignition (HCCI) of said liquid fuel.

32. The method as recited in claim 31, wherein the injecting step comprises injecting atomized droplets having a mean diameter of between about 5 microns and about 20 microns.

33. The method as recited in claim 31, wherein, after the injecting step, said liquid fuel evaporates and cools the air in said mixture.

34. The method as recited in claim 31, wherein said liquid fuel is injected via at least one fogging nozzle.

35. The method as recited in claim 31, wherein said liquid fuel is injected via a plurality of fogging nozzles, and further comprising adjusting a fuel supply quantity by at least one of

A) adjusting fuel supply pressure;

B) pulse-width-modulating flow through at least one of said nozzles;

C) varying an orifice diameter of at least one of said nozzles; and

D) disabling at least one of said nozzles.

36. The method as recited in claim 34, wherein said fogging nozzle has an impaction device against which injected fuel impinges to atomize fuel droplets.

37. The method as recited in claim 31, wherein

said liquid fuel is a primary fuel, and further comprising injecting a relatively small volume of a pilot fuel into said combustion chamber, said pilot fuel having a lower autoignition temperature than said primary fuel and having a relatively narrow boiling point temperature range; and wherein

the compression ignition step comprises autoigniting said pilot fuel by compression ignition and igniting said primary fuel through combustion of said pilot fuel, thereby obtaining pilot assisted HCCI of said primary fuel.

38. The method as recited in claim 37, wherein said pilot fuel comprises diesel fuel and said primary fuel comprises Dimethyl Ether.

39. The method as recited in claim 37, further controlling at least one of a timing, Tp, of initiation of pilot fuel injection, a pilot fuel injection duration, Dp, and an ignition delay period, Di, such that Dp/Di is < 1.

40. A method of operating an engine having a cylinder which includes an engine head and a piston which is reciprocateably translatable in the cylinder to define a variable-volume combustion chamber between the engine head and the piston, the method comprising the steps of:

(A) performing an intake stroke of the piston;

(B) performing a compression stroke of the piston after the intake stroke;

(C) admitting a homogenous charge of a liquid fuel and air into the combustion chamber during one of the intake stroke and the compression stroke, said homogenous charge being formed by injecting said liquid fuel into the intake air stream in the form of atomized droplets having a mean diameter of less than about 30 microns;

(D) injecting a pilot fuel charge into the combustion chamber during the compression stroke, said pilot fuel having a lower autoignition temperature than said primary fuel and having a relatively narrow boiling point temperature range;

(E) combusting said pilot fuel charge to ignite said primary fuel by HCCI, wherein the steps of injecting the pilot fuel charge and igniting the pilot fuel charge comprise, on a cycle-by-cycle, full load and speed range basis

(1) initiating pilot fuel injection at a time, Tp,

(2) continuing pilot fuel injection for a duration, Dp, and

(3) igniting the pilot fuel charge by compression-ignition at an autoignition point, Ti, occurring an ignition delay interval Di after Tp; and

(4) controlling at least one of Tp, Dp, and Di to maintain $Dp/Di < 1$.